

# Update: Outbreak of Severe Acute Respiratory Syndrome --- Worldwide, 2003

Please note: An erratum has been published for this article. To view the erratum, please click [here](#).

CDC continues to support the World Health Organization (WHO) in the investigation of a multicountry outbreak of unexplained atypical pneumonia referred to as severe acute respiratory syndrome (SARS) (1). This report includes summaries of the epidemiologic investigations and public health responses in several affected locations where CDC is collaborating with international and national health authorities. This report also describes an unusual cluster of cases associated with a hotel in Hong Kong and identifies the potential etiologic agent of SARS. Epidemiologic and laboratory investigations of SARS are ongoing.

As of March 26, a total of 1,323 suspected and/or probable SARS cases have been reported to WHO from 14 locations (2), using the WHO case definition or country-specific variations\* (3). These reported SARS cases include 49 deaths (case-fatality proportion: 4%). The Chinese authorities have reported 79 suspected/probable cases, including 31 deaths, which occurred in Guangdong province during November 16, 2002–February 28, 2003.

CDC is assisting in epidemiologic investigations of cases in Hong Kong, Vietnam, Taiwan, and Thailand. CDC also is conducting surveillance and prevention activities in the United States.

**Hong Kong.** As of March 25, the Hong Kong Department of Health (DH) reported 290 suspected and probable SARS cases. Beginning on March 11, an increase in acute pneumonia cases among health-care workers (HCWs) at hospital 1 in Hong Kong was reported to DH. Epidemiologic investigation has linked these cases to an index patient (Patient J) who visited a friend in hotel M in late February, became ill a few days later, and was admitted to hospital 1 on March 4 (Figure 1). Patient J visited hotel M while patient A, an ill visitor from Guangdong province, was staying there.

As of March 25, a cluster of 13 persons with suspected/probable SARS are known to have stayed at hotel M (Figure 1). The index patient (patient A) had onset of symptoms on February 15. He traveled from Guangdong province to Hong Kong to visit family and stayed on the ninth floor of the hotel on February 21. He was admitted to hospital 2 on February 22 and died the next day. Four HCWs and two of his family members subsequently became ill; one family member died. Of the 12 other patients linked to hotel M, 10 were in the hotel the same day as the index patient; the other two patients (patients L and M) stayed in the hotel during the time that three other symptomatic patients were guests in the hotel. Nine of the 13 patients, including patient A, stayed on the ninth floor; one stayed on the 14th floor; one stayed on the 11th floor; and two stayed on both the ninth and 14th floors. Epidemiologic investigations have identified patients from this cluster as index patients in subsequent clusters in Hong Kong and other areas. Patient B is the index patient for the outbreak in Hanoi involving 59 HCWs and close contacts and also is linked to one case in Thailand. Patients C, D, and E are associated with 70 cases in Singapore and three cases in Germany. Patient F is linked with a cluster of 16 other cases in Toronto (4). Patients H and J are linked with outbreaks among HCWs in other hospitals in Hong Kong. Patient L appears to have become infected during his stay at hotel M, with subsequent transmission to his wife, patient M.

RNA virus) has been associated previously with respiratory disease with much less frequent occurrence of severe disease than SARS. Coronaviruses are enveloped, single-stranded RNA viruses that infect both humans and animals (5). The known human coronaviruses can cause serious infections of the lower respiratory tract in children and adults and necrotizing enterocolitis in newborns (5,6). Coronaviruses are able to survive on environmental surfaces for up to 3 hours (6). Coronaviruses might be transmitted person-to-person by droplets, hand contamination, fomites, and small particle aerosols (7).

Clinicians evaluating suspected cases should use standard precautions (e.g., hand hygiene) together with airborne (e.g., N-95 respirator) and contact (e.g., gowns and gloves) precautions (8). Until the mode of transmission has been defined more precisely, eye protection also should be worn for all patient contact. As more clinical and epidemiologic information becomes available, interim recommendations will be updated.

The international spread of disease underscores the need for strong global public health systems, robust health service infrastructures, and expertise that can be mobilized quickly across national boundaries to mirror disease movements. The Institute of Medicine has recently issued recommendations for invigorating the response to emerging infectious diseases that reflect these needs, including the development of a comprehensive system of surveillance for global infectious diseases, the enhancement of disease reporting, the development of diagnostic tests, and the formulation and distribution of guidelines on diagnosis (9).

## References

1. CDC. Outbreak of severe acute respiratory syndrome--worldwide, 2003. *MMWR* 2003;52:226--8.
2. World Health Organization. Cumulative number of reported cases (SARS). Available at [http://www.who.int/csr/sarscountry/2003\\_03\\_26/en](http://www.who.int/csr/sarscountry/2003_03_26/en).
3. World Health Organization. Case definitions for surveillance of severe acute respiratory syndrome (SARS). Available at <http://www.who.int/csr/sars/casedefinition/en>.
4. Health Canada. Epidemiology, clinical presentation and laboratory investigation of severe acute respiratory syndrome (SARS) in Canada, March 2003. Available at <http://www.hc-sc.gc.ca/pphb-dgspsp/publicat/ccdr-rmtc/03vol29/prev/dr-sars0325.html>.
5. McIntosh K. Coronaviruses. In: Mandell GL, Bennett JE, Dolin R, eds. *Mandell, Douglas, and Bennett's Principles and Practice of Infectious Diseases*, 5th ed. Philadelphia: Churchill Livingstone, Inc., 2000.
6. Sizun J, Yu MWN, Talbot PJ. Survival of human coronaviruses 229E and OC43 in suspension after drying on surfaces: a possible source of hospital-acquired infections. *J Hosp Infect* 2000;46:55--60.
7. Ijaz MK, Brunner AH, Sattar SA, Nair RC, Johnson-Lussenburg CM. Survival characteristics of airborne human coronavirus 229E. *J Gen Virol* 1985;66:2743--8.
8. CDC. Updated interim domestic infection control guidance in the health care and community setting for patients with suspected SARS. Available at <http://www.cdc.gov/ncidod/sars/infectioncontrol.htm>.
9. Institute of Medicine. *Microbial Threats to Health: Emergence, Detection, and Response*. Smolinski MS, Hamburg MA, Lederberg J, eds. Washington DC: The National Academies Press, 2003. Available at <http://www.nap.edu/books/030908864X/html>.

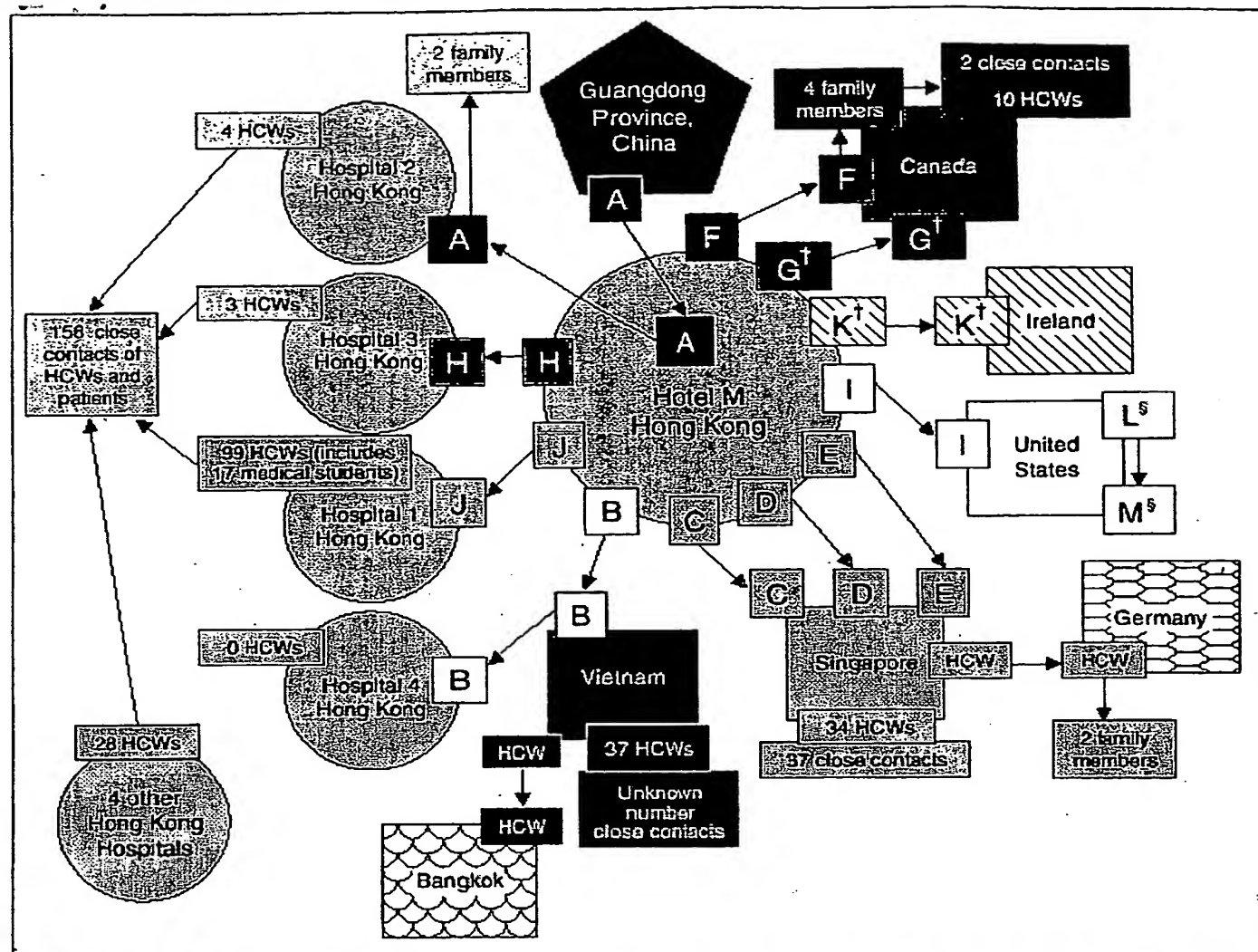
\* WHO defines (3) a suspected case as an illness that occurs in a person presenting after February 1, 2003, with a history of high fever (>100.4 °F [ >38 °C]); one or more respiratory symptoms, including cough, shortness of breath, and difficulty breathing; and close contact within 10 days of symptoms onset with a person in whom SARS has been diagnosed and/or a history of travel within 10 days of onset of symptoms to an area with reported foci of SARS transmission. WHO defines a probable case as a suspected case of illness that occurs in a person with either 1) chest radiograph findings of pneumonia or respiratory distress syndrome (RDS) or 2) unexplained respiratory illness resulting in death, with autopsy examination demonstrating pathology of RDS but no identifiable cause.

† Persons who have cared for, lived with, or had direct contact with respiratory secretions and body fluids of a person with SARS.

Figure 1

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FIGURE 1. Chain of transmission among guests at Hotel M — Hong Kong, 2003



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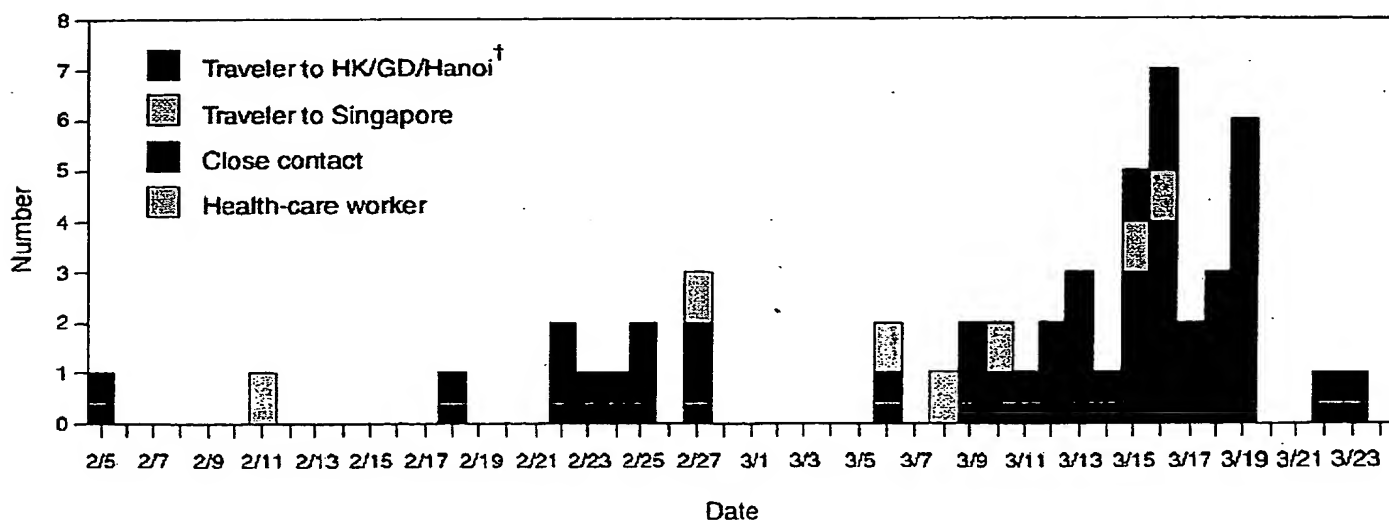
\* Health-care workers.

† All guests except G and K stayed on the 9th floor of the hotel. Guest G stayed on the 14th floor, and Guest K stayed on the 11th floor.

§ Guests L and M (spouses) were not at Hotel M during the same time as index Guest A but were at the hotel during the same times as Guests G, H, and I, who were ill during this period.

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Figure 2

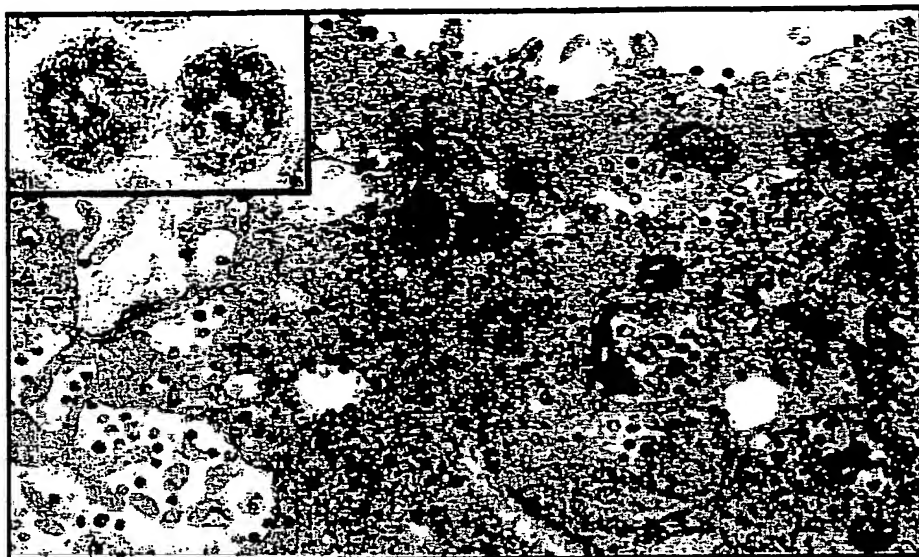
FIGURE 2. Number of suspected cases\* of severe acute respiratory syndrome, by exposure category and date of illness onset — United States, 2003



\* N = 51.

† HK = Hong Kong Special Administrative Region, China; GD = Guangdong province, China; Hanoi = Hanoi, Vietnam.

**FIGURE 3.** Thin section electron micrograph of infected Vero E6 cell, showing coronavirus particles within cytoplasmic membrane-bound vacuoles and the cisternae of the rough endoplasmic reticulum. Extracellular particles accumulate in large clusters, and are frequently seen lining the surface of the plasma membrane. Inset, higher magnification of coronavirus particles.



Photo/CDC.

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Table

**TABLE.** Exposure category, clinical features, and demographics of reported severe acute respiratory syndrome (SARS) cases\* — selected locations, 2003

Category	Hong Kong		Vietnam		Thailand		Taiwan		United States	
	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
<b>Total cases†</b>	290 <sup>§</sup>	(100)	59	(100)	4	(100)	6	(100)	51 <sup>§</sup>	(100)
	(As of 3/25/03—S/P)		(As of 3/24/03—P)		(As of 3/23/03—S/P)		(As of 3/25/03—P)		(As of 3/26/03—S)	
<b>Exposure</b>										
Health-care worker	134	(46)	37	(63)	1	(25)	0		2	(4)
Close contact†	156	**	NA††		0		2	(33)	5	(10)
<b>Clinical features</b>										
Ever hospitalized	290	(100) <sup>§</sup>	59	(100)	4	(100)	6	(100)	20 <sup>§</sup>	(39)
Pneumonia	288	(99)	NA		3	(75)	6	(100)	14	(27)
Ever ventilated	NA		5	(9)	1	(25)	2	(33)	1	(2)
Dead	10	(4) <sup>§</sup>	2	(3)	0		0		0 <sup>§</sup>	
<b>Demographics</b>										
Age	NA		Median: 38 yrs		Median: 38 yrs		Median: 53 yrs		Median: 42 yrs	
	NA		(range: 18–66 yrs)		(range: 1–49 yrs)		(range: 25–64 yrs)		(range: 8 mos–78 yrs)	
<b>Sex<sup>§§</sup></b>										
Female	Approximately 50%		37	(63)	1	(25)	3	(50)	28	(51)
Male	Approximately 50%		22	(37)	3	(75)	3	(50)	25	(49)

\* Locations used different SARS case definitions.

† S = Suspected case; P = Probable case; U = Unknown.

§ One U.S. resident (Patient B) was hospitalized in Vietnam and died in Hong Kong before he could return to the United States. He is counted as a Hong Kong case.

† Person having cared for, lived with, or had direct contact with respiratory secretions and body fluids of a person with SARS.

\*\* Of the 290 SARS patients in Hong Kong, most of the remaining 156 patients are believed to be close contacts.

†† Not Available.

§§ Only percentages were reported for sex data.

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Box

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**BOX. CDC updated interim case definition for severe acute respiratory syndrome (SARS)\***

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**Suspected case†**

Respiratory illness of unknown etiology with onset since February 1, 2003, and the following criteria:

- Measured temperature >100.4°F (>38.0°C)
- One or more clinical findings of respiratory illness (e.g., cough, shortness of breath, difficulty breathing, hypoxia, or radiographic findings of either pneumonia or acute respiratory distress syndrome)
- Travel within 10 days of onset of symptoms to an area with suspected or documented community transmission of SARS,§ (excluding areas with secondary cases limited to health-care workers or direct household contacts)

OR

- Close contact‡ within 10 days of onset of symptoms with either a person with a respiratory illness and travel to a SARS area or a person under investigation or suspected of having SARS

\* As of March 22, 2003.

† Suspected cases with either radiographic evidence of pneumonia or respiratory distress syndrome, or evidence of unexplained respiratory distress syndrome by autopsy, are designated "probable" cases by the World Health Organization case definition.

§ Hong Kong Special Administrative Region and Guangdong province, China; Hanoi, Vietnam; and Singapore.

‡ Close contact is defined as having cared for, having lived with, or having had direct contact with respiratory secretions and/or body fluids of a patient suspected of having SARS.

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